(abundance of suitable nourishment the primary condition); theory of propagation; animal ethics; and lastly, human ethics.

Abriss der Zoologie für Studirende, Ärzte und Lehrer. Von Dr. A. Brass. (Leipzig: W. Engelmann, 1882.)

IN this octavo volume of over 360 pages we have a sketch of the modern aspect of zoology fairly well executed, and with woodcut illustrations after Frey, Hæckel, Kölliker, and Gegenbaur. The first section treats of zoology in general, discusses the subject of the differences between the animal and vegetable kingdoms, and considers the animal in general. The second section is devoted to the morphology and developmental history of animals. The third is the systematic portion. The classification adopted is for the most part a copy of Claus's. The volume forms a handy compendium of zoological science, and, like all the works from the establishment of the well-known Leipzig publisher, is well printed on good paper.

The Two Hemispheres: A Popular Account of the Countries and Peoples of the World. By G. G. Chisholm, M.A. Illustrations. (London: Blackie and Son, 1882.)

THIS work contains in one volume much useful geographical information, methodically arranged. It is, indeed, a systematic and succinct account of the various continents, countries, and oceans, somewhat after the style of a gazetteer, for which it may be used by means of the copious index. The information seems to us in the main accurate, though many of the illustrations appear well worn. Mr. Chisholm, however, gives the old erroneous measurements of Mounts St. Elias and Fairweather, in Alaska, evidently unaware of the survey made by Dall six years ago, and which showed them to be 4000 feet higher than given here.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Sun-spots

THE spot seen on the sun by Mr. W. A. Holland (NATURE, vol. xxv. p. 316) would appear to have been simply a large sun-spot which made its appearance at the sun's east limb on November 15, and went off the disk on November 27. It is shown on photographs taken at Greenwich on November 16, 17, 18, 19, 20, 21, 23, 26, and 27. On November 21, 11h. a.m. it was north-east of the centre, Pos-angle 50° 27′, Dist. 0·188 of sun's radius, and on November 23 0h. it was north-west of the centre Pos-angle 313° 39′ dist. 0·412. The estimate of its size by Mr. Holland is very much exaggerated, the dimensions of the whole spot (nucleus and penumbra), as measured on the photographs, being one-twentieth of the sun's diameter in length, and one-twenty-fifth in breadth. The area, corrected for foreshortening and expressed in millionths of the sun's visible hemisphere, was 832 for the whole spot, and 152 for the nucleus on November 21, and 970 for the whole spot, and 171 for the nucleus on November 23. The spot had begun to break up between November 21 and 23, and the area for November 21 is really the largest as applying to a single undivided spot. This spot is one of the largest yet recorded at Greenwich. Two other large spots of about the same size were photographed in 1881, on March 22 and June 1, their areas being respectively 919 for the whole spot, and 195 for the nucleus; and 931 for the whole spot, and 158 for the nucleus. The next largest spot in previous years was that of 1877 November, with an area of 801 for the whole spot, and 109 for the nucleus.

While on the subject of sun-spots, I may mention with reference to Mr. J. B. N. Hennessey's letters on an Outburst of Sun Spots (NATURE, vol. xxiv. p. 508, and vol. xxv. p. 241) that a photograph taken at Greenwich, 1881, July, 24d 23h. 11m. 10s., G.M.T., only 11m. before the new group was noticed on the ground-glass at Dehra Doon, shows no indication whatever of the group in question, and that no trace of it appears on a photograph taken next morning, July 25, 22h. 17m. 55s. G.M.T. Thus the new group, if real, must have formed suddenly in less than eleven minutes at a part of the sun's surface where there was not the slightest previous disturbance of the photosphere, and must have completely disappeared within the space of 23h. It might have been expected that the granules of the photosphere, which are well defined in the Greenwich photographs referred to, would have given some indication of such an outburst.

W. H. M. CHRISTIE.

Royal Observatory, Greenwich, February 6

THE importance attached to the solar observations of Mr. W. A. Holland by so great an authority as Sir W. Thomson, would alone suffice to warrant me in forwarding for your publication exact drawings of the spots observed on November 22 and 23 of last year, and the wording of the letters of Mr. Holland makes it still more urgent to determine the precise extent of the spots in question.

The small optical power used on November 22 and 23, on board the *Sarah Bell*, places the result almost on a level with direct eye observations, and the description strongly recalls to mind the accounts given of solar spots previous to the discovery of the telescope. Thus on November 22 we have two eye-estimates of the size of the spot. "I, myself," writes Mr. H., "estimated the spot on the sun to be $\frac{1}{4}$ diam., but conferring with the captain, he estimated it to be $\frac{1}{3}$ diam.; it was purely an estimate of the eye."

The pictures of the sun, which I inclose, were taken at Stony hurst Observatory on November 20 and 22, and they give an exact outline of the spot seen on board the *Sarah Bell*, clearly showing what meaning we may reasonably attach to those ancient carefully denoted sun-spots, which were said to have a diameter equal to $\frac{1}{4}$, $\frac{1}{8}$, or even $\frac{1}{2}$ of the solar disk. The length of the spot observed on November 22 agrees very fairly with Mr. H.'s approximate estimate, if we include the whole group, but this gives a very incorrect notion of the spot-area, and of the disturbing forces then apparently at work in the sun.

From accurate measurements of the original drawings, which give the relative dimensions of the spots on the solar disk, I find the diameter of the sun to be 267 mm., the length of the group 54 mm., and its breadth 22 mm., whilst the length of the large spot, including its whole penumbra, is only 15 mm. The group is a scattered one, and the whole spot area in the picture can scarcely exceed 225 sq. mm., and therefore, being situated almost at the centre of the disk, will not cover more than one thousandth part of the visible hemispheres, although the whole group is spread over a space nearly five times as large. We thus get a more correct notion of the disturbance on the solar surface than by measuring merely the diameter of the group, or by expressing the spot area in millions of square miles.

The drawing of November 22 contains another spot in the *n.p.* quadrant, which is not mentioned by Mr. Holland, but which a few days previously, when nearer the centre of the disk, was as conspicuous an object as the spot under discussion, and was easily seen by the naked eye on November 18, shortly after sunrise. The group which followed was then near the limb, and was a fine object in a small binocular, but not visible to the naked eye.

The fact of two separate spots, each seen easily without a telescope, being on different portions of the solar disk at the same time is, I think, rather extraordinary, but the area covered by spots has never approached of late to what was sketched by Tacchini in 1871, or even what was photographed by Rutherfurd in 1870. I might perhaps also mention that the spot which crossed the disk in May and June was as large as that of November.

S. J. PERRY

Stonyhurst Observatory, Whalley, February 5

[The drawings sent by Mr. Perry seem to us to quite bear out his statements.—ED.]

Rime Cloud observed in a Balloon

A SINGULAR phenomenon was observed in Paris in the month of January. An obscure cloud remained in a state of suspen-

sion over Paris and a large tract of the country from the 4th up to the 26th, without any intermission. Neither sun, nor stars, nor moon were visible for an instant during that lengthened period.

The prevailing opinion among meteorologists was that the nebulosity was formed by a mass of snow suspended in the atmosphere.

Although the notion was generally accepted, I opposed it, in my contributions to *L'Electricité*, remarking that if such were the case, snow or at least water should have fallen in Paris and vicinity where the dryness was complete from the apparition of this remarkable nebulosity. But being unable to settle the controversy without actual observation, I ascended in a balloon from La Villette Gas Works on January 25 at 2h. 35. p.m. I found my anticipations were quite correct, as not a single flake of snow was seen by me or by M. Anatole Brissonet, a young gentleman who was assisting me by manœuvring the balloon. But I was quite deceived in the thickness of the cloud, which did not exceed 300 metres, although it rendered the sun perfectly invisible, and I had written it ought to be numbered by thousands.

The earth was lost sight of gradually, and was perfectly invisible at 270 metres, but the sun was shining in all its glory at 580 metres, with blue sky. The cloud was not so blinding as usual when it is composed of condensed vapour, as the thermometer and barometer could be read with perfect accuracy in the centre of it, and the lower part of the balloon was entirely visible at a distance of about 4 or 5 metres, but the equator was lost in whitish smoke perfectly impenetrable to sight. This nebulous matter appeared perfectly homogeneous, and I could see no trace of any crystalline matter, but an unexpected observation proved that it was formed of minute solidified atoms of water in a real microscopic state of division.

When we emerged from the cloud gently and slowly, I stop the throwing out of any ballast in order to remain in close vicinity of its surface. M. Brissonet and I observed carefully what was occurring around us. The heating effect of the sun was in some respect destroyed by the radiation towards the cloud, which was at a temperature of 5° C. So we were floating at a level almost perfectly equal, in an air at a temperature from $-2°$ to $-3°$. The air at the surface of the clouds was perfectly calm, but at a few metres upwards it was moving north-north-easterly at a rate of eight miles an hour. The consequence was that we we were towed by the globe, and feeling keenly a cold current sweeping over our faces. We had uncoiled our guide rope, the length of which was 60 metres, and the end of which was consequently immersed in the cloud and dragged into it. To our intense surprise, and I may say delight, we perceived that this part was quite loaded with hoar frost, which had precipitated regularly by series of hairs a few millimetres long. These accumulations during a sweep which lasted for an hour, and a distance of about eight miles, are consistent with the fact previously stated, that no deposit was visible during our ascent, which had been very slow indeed. My calculations show that our vertical velocity was not exceeding 30 metres per minute, which is only one-eighth of our horizontal velocity, continued during six times longer. In our descent, which was rather quicker, but not to a great degree, the sweeping may have accumulated the frost rime on the bottom of the car, which it could not have been easy to observe, and consequently I cannot state what occurred, but not a single crystal was deposited on our ropes during that period.

I have been unable to procure Scoresby's Sketches of the Polar Regions, but only a review by Arago, who says (ix. p. 357, 10, *et seq.*) : The "*frost-rime* ou fumée-gelée est un phénomène particulier des ces regions de la terre ou le froid est de longue durée, dont une vapeur dense[1] qui est dans un état complet de congelation. . . . Les parties extrémement deliées dont le *frost-rime* se compose s'attachent à tous les corps vers lesquels le vent les pousse, et y forment quelque fois une croûte de plus de 3 centimètres d'epaisseur, herisse de longues files prismatiques, ou pyramidales la pointe dirigée du côté du vent."

It seems to me that the constitution of cirrus clouds seems to be explained by these properties of *frost-rime* clouds. These minute crystals, which can remain for an indefinite period suspended in the air, are, properly speaking, the *materies nivei*, but not *nives ipsa*. It is by motion, either vertical or horizontal, that they are changed either into hoar-frost or snow, according to circumstances.

W. DE FONVIELLE

[1] I suppose that Scoresby is speaking of optical density.

Researches on Animals containing Chlorophyll

MR. PATRICK GEDDES appears to have been anticipated in most of the points set forth in his paper on Further Researches on Animals containing Chlorophyll, published in NATURE of January 26 last, by Dr. Brandt, of Berlin, who, in a paper read before the Physiological Society of Berlin on November 11 last, and published in the *Proceedings* of the Society on the "Symbiosis of Lower Animals with Algæ," describes the cultivation, after removal from the bodies of the various animals affected by them, of the well-known yellow and green chlorophyll-containing bodies, their development of starch grains, and their successful artificial implantation into the bodies of fresh hosts previously free from them; this latter being an important fact apparently not known to Mr. Geddes. Dr. Brandt further names the species of algæ in question under two genera, Zoochlorella and Zooxanthella, and gives to the peculiar physiological relations of mutual advantage between the plants and animals the term "symbiosis." Mr. Geddes appears not to have seen this paper of Dr. Brandt, since he merely refers to some of his earlier papers on the same subject, but it is important. Dr. Brandt's claims in the matter should not pass without notice in NATURE. I have not seen Dr. Brandt's original paper, but only an abstract published in the *Naturforscher* of January 14 last, from which I take the information given above.

H. N. MOSELEY

The Movements of Jupiter's Atmosphere

IN NATURE, vol. xxv. p. 213, Mr. Darwin describes the bands on Jupiter as "due to the trades and anti-trades" set in motion by the action of solar radiation on the solid body of the planet as are the trade-winds of the earth. Many other eminent astronomers still appear to accept this time-honoured explanation of the phenomena.

Have they reflected on the revelations supplied by the low specific gravity of Jupiter? There is no form of matter with which we are acquainted that could exist at a mean density of about one-fourth of that of the earth, while subject to the enormous pressure due to the mass of Jupiter, unless it were sufficiently hot to render the formation of a solid crust on its surface quite impossible. In order to attribute terrestrial solidity to either Jupiter, Saturn, Uranus, or Neptune we must invent a new kind of matter as infusible as platinum, and far lighter than hydrogen, or endow it with absolute incompressibility.

These planets, if composed of any of the chemical elements or compounds known to us, can only retain their low density under the enormous pressure of their masses by the agency of proportionately counteracting heat-repulsion. At and about their centres this may be so far overcome by the superincumbent pressure as to produce solid nuclei, but these must be very small in proportion to the mass of the planet.

Assuming the existence of such a central nucleus of Jupiter surrounded by a great fluid envelope, how will it be affected by the gravitating reaction of the satellite, supposing the compression to give it a specific gravity exceeding the mean specific gravity of its envelope?

It will obviously perform an eccentric rotation, or reeling, within the envelope. This motion must be very irregular and complex, owing to the different periods and the varying relative positions of the satellites; but the varying resultant of their gravitation forces will have one element of constancy, viz. a close coincidence with the plane of the planet's equator.

The effect of such internal reeling upon the surrounding gaseous mass explains far more efficiently than any possibility of solar radiation, the disturbances indicated by the ever changing belts and spots of this planet; and also the greater rotatory velocity of the equatorial spots, described by Mr. Denning in the above-named number of NATURE, p. 225.

The correspondence of these with the varieties of rotation of the different parts of the solar surface observed by Carrington, is well worthy of note, and admit of similar explanation; planetary reaction in the case of the sun taking the place of the satellite reaction on Jupiter. In my essay on "The Fuel of the Sun" I have worked out other consequences of this reeling of the solar nucleus and their analogues in the greater planets.

Stonebridge Park, January 26 W. MATTIEU WILLIAMS

"The Lepidoptera of Ceylon"

MR. F. MOORE in no way betters the case against him by his letter printed in NATURE, vol. xxv. p. 79. The name of George